Ordering number: EN3309C

Monolithic Linear IC

LA4425A

5 W Power Amplifier with Very Few External Parts for Car Radio and Car Stereo

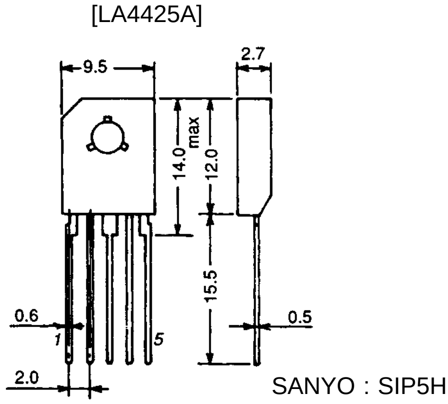
Features

- The world's first power amplifier with very few external parts.
  The smallest package in the industry
  → [SIP-5H (TO-126 type)]
  Only two external parts
  → [Only I/O coupling capacitors]
- Almost no evaluation, adjustment and check of its functions as a power IC required
  → [Simplified control]
- Wide operation supply range → 5 to 16 V
- On-chip protection:
  Overvoltage protection
  Thermal protection
  Output D.C. short protection
- On-chip pop noise reducing circuit

Package Dimensions

unit : mm

3031A-SIP-5H



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max	Rg = 0	18	V
Surge maximum supply voltage	V_{CC} surge	Giant pulse 200 msec Rise time 1 ms	50	V
Maximum output current	I_O peak		3.3	A
Allowable power dissipation	Pd max	With infinite heat sink	7.5	W
Operating temperature	Topr		–30 to +80	°C
Storage temperature	Tstg		–40 to +150	°C

Operating Conditions at Ta = 25°C

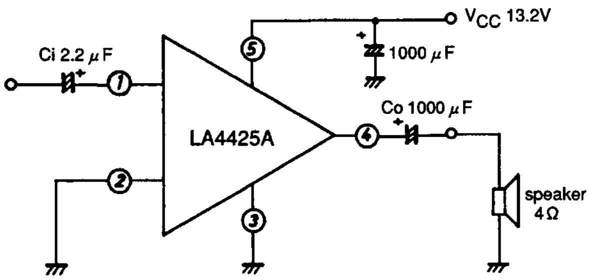
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		13.2	V
Recommended load resistance	R_L		4	Ω
Operating voltage range	V_{CC} op		5 to 16	V
Operating load resistance range	R_L op	Under conditions where maximum ratings are not exceeded	2 to 8	Ω

SANYO Electric Co.,Ltd. Semiconductor Bussiness Headquarters
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110 JAPAN

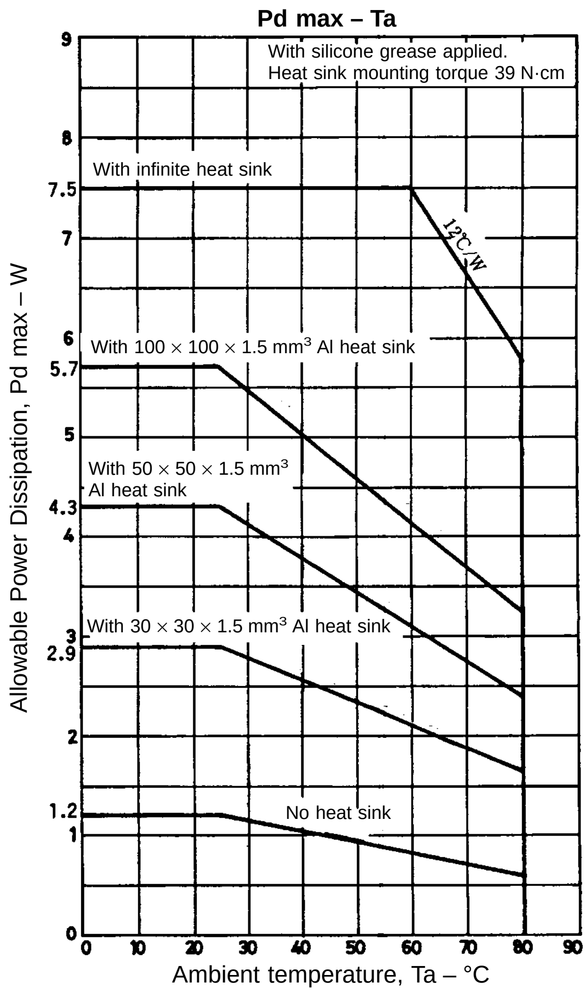
Operating Characteristics at Ta = 25°C, V_{CC} = 13.2 V, R_L = 4 Ω, f = 1 kHz, Rg = 600 Ω, specified board/specified circuit, 30 × 30 × 1.5 mm^3 thick aluminum used

Parameter	Symbol	Conditions	min	typ	max	Unit
Quiescent current	I_{CCO}			65	130	mA
Voltage gain	VG	V_O = 0 dBm	43	45	47	dB
Output power	P_O1	13.2 V/4 Ω, THD = 10%	4	5		W
	P_O2	14.4 V/4 Ω, THD = 10%	5	6		W
Total harmonic distortion	THD	V_O = 2V		0.1	1.0	%
Output noise voltage	V_{NO}	Rg = 0, BPF = 20 Hz to 20 kHz		0.15	0.5	mV
Ripple rejection ratio	$SVRR_1$	Rg = 0, BPF = 20 Hz to 20 kHz V_R = 0 dBm, f_R = 100 Hz	30	40		dB
	$SVRR_2$	Rg = 0, BPF = 20 Hz to 20 kHz V_R = 0 dBm, f_R = 1 kHz		47		dB
Overvoltage attack	V_{CCX}	Rg = 0		21.5		V
Starting time	t_s			0.35		s
Input resistance	R_{IN}			50		kΩ
Roll-off frequency	f_L			40		Hz
	f_H			90		kHz
Thermal operating temperature	Tc			125		°C

Sample Application Circuit



- On-chip overvoltage protection
- On-chip thermal protection
- On-chip pop noise reducing circuit
- On-chip output D.C. short protection



Pin Voltage at V_{CC} = 13.2 V

Characteristics	Input	Small signal GND	Large signal GND	Output	V_{CC}
Pin No.	1	2	3	4	5
Pin voltage (reference value)	(≒ 2 V_{BE}) 1.4 V	0 V	0 V	(≒ 1/2 V_{CC}) 6.5 V	(V_{CC}) 13.2 V

IC Usage Notes

Maximum ratings

If the IC is used in the vicinity of the maximum ratings, even a slight variation in conditions may cause the maximum ratings to be exceeded, thereby leading to a breakdown.

Printed circuit board

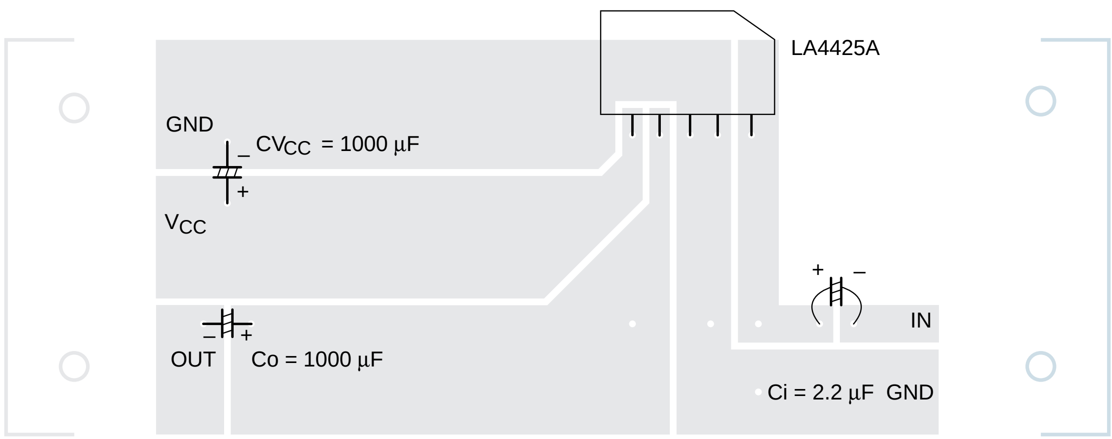
When drawing the printed circuit pattern, refer to the sample printed circuit pattern. Be careful not to form a feedback loop between input and output.

Comparison of External Components

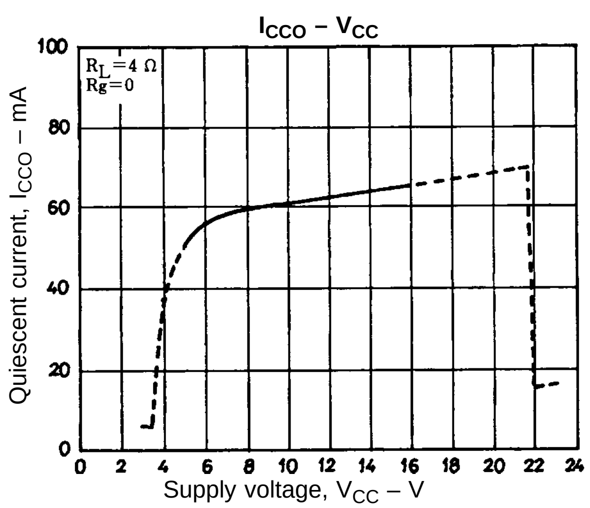
External Parts	Our ICs now in use	LA4425A
Output coupling capacitor	○	○
Input coupling capacitor	○	○
Bootstrap capacitor	○	—
Feedback capacitor	○	—
Filter capacitor	○	—
Phase compensation capacitor	○	—
Oscillation correction polyester film capacitor	○	—
Oscillation correction resistor	○	—
Total	8 pcs.	2 pcs.

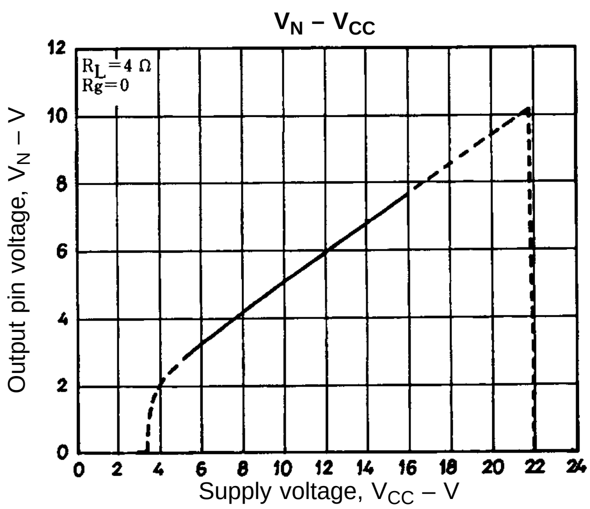
Note: The power supply capacitor is not counted as a power IC part.

Sample Printed Circuit Pattern

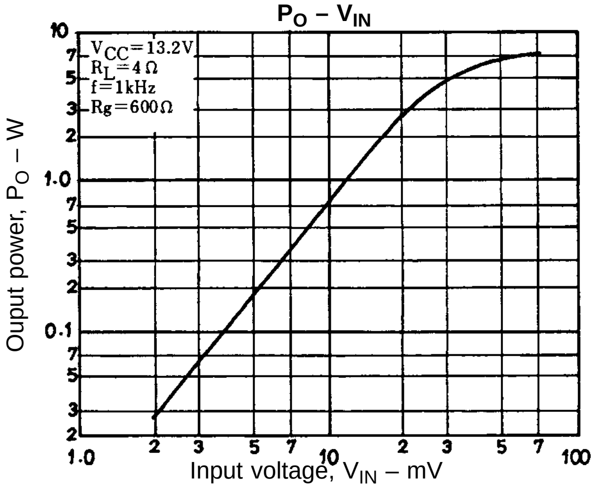


Cu-foiled side 78.0 × 29.0 mm^2

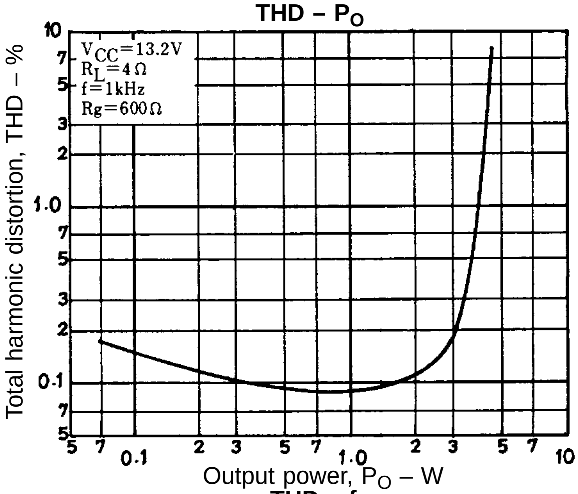




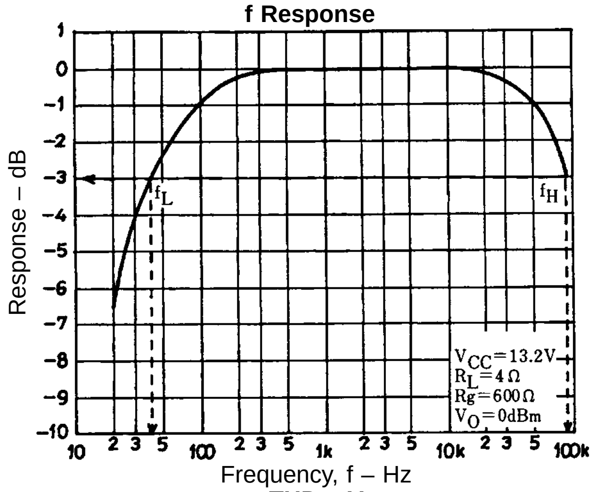
P_O – V_{IN}



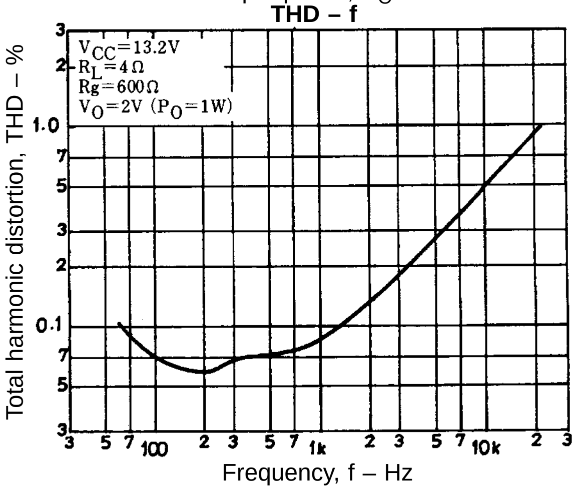
THD – P_O



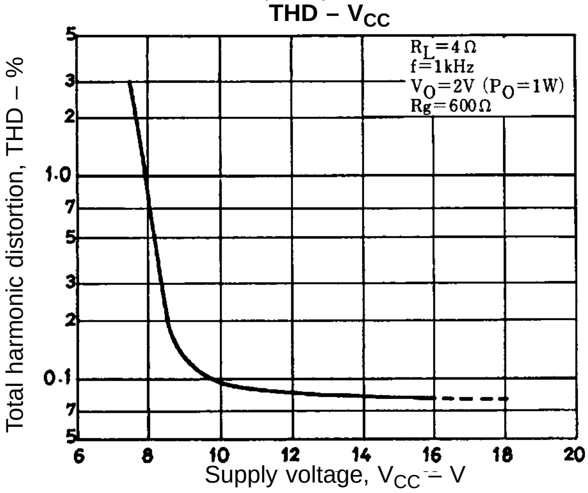
f Response



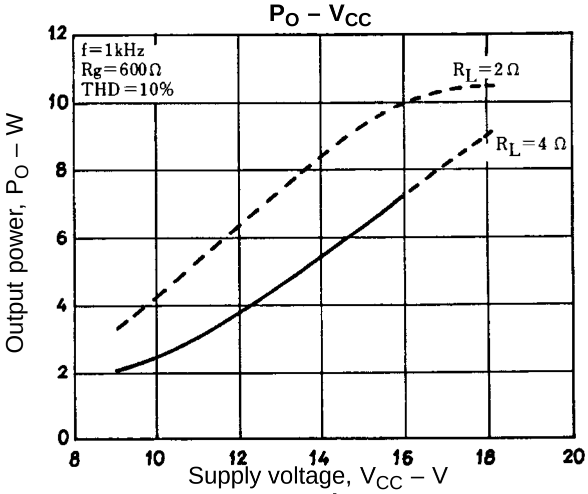
THD – f



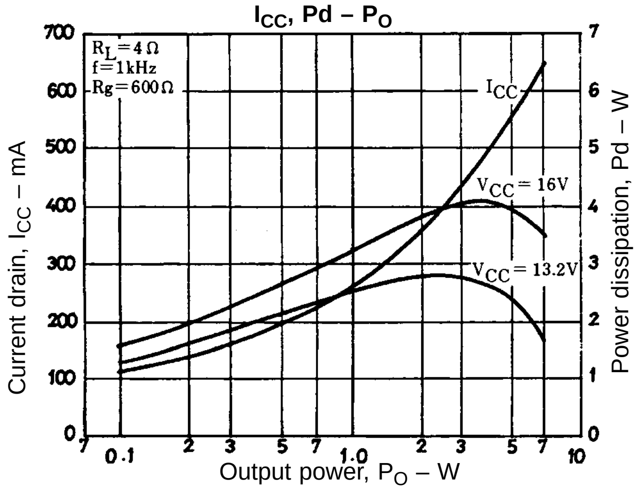
THD – V_{CC}



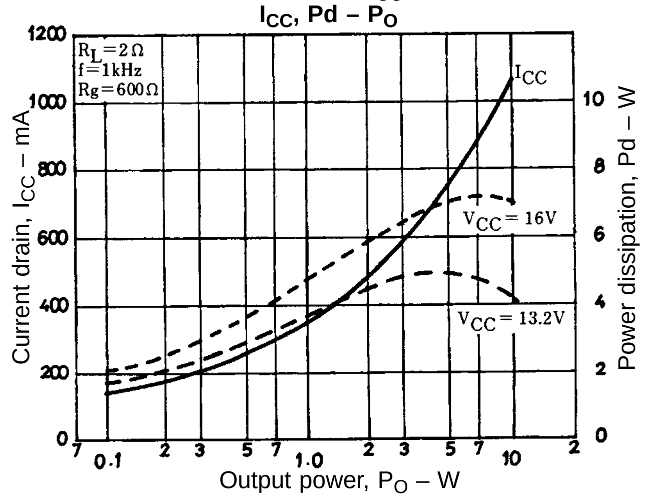
P_O – V_{CC}



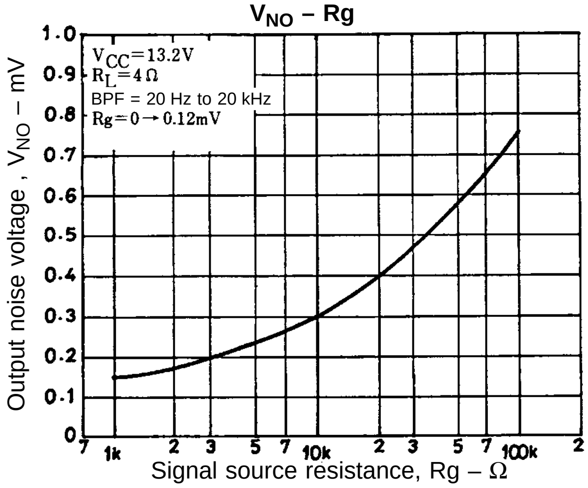
I_{CC}, Pd – P_O



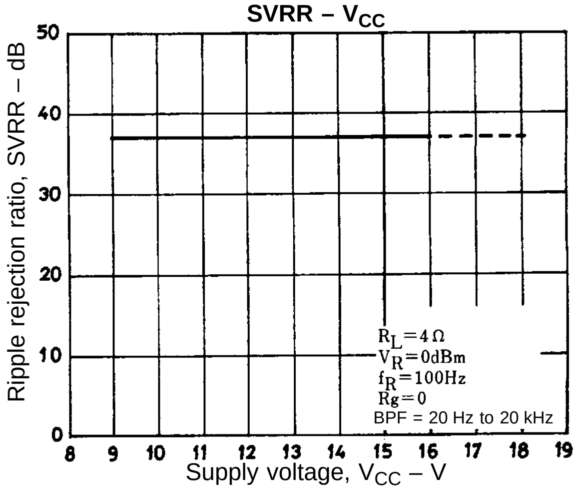
I_{CC}, Pd – P_O



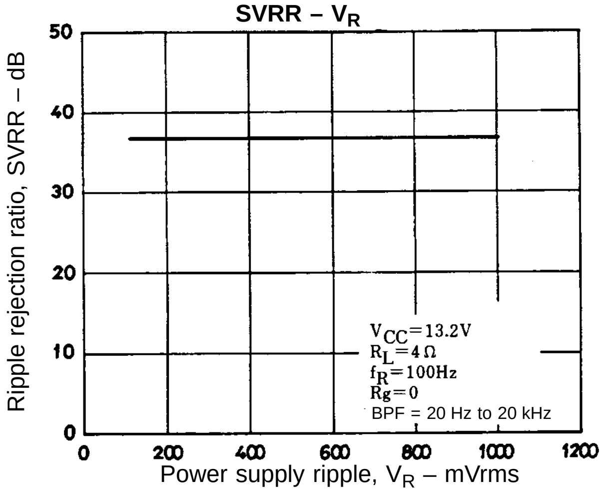
V_{NO} – Rg



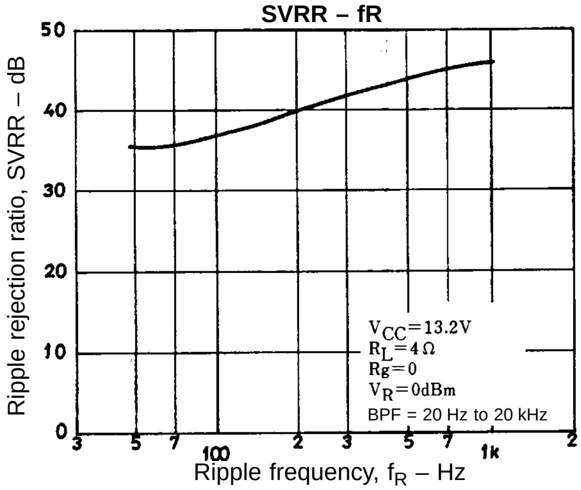
SVRR – V_{CC}



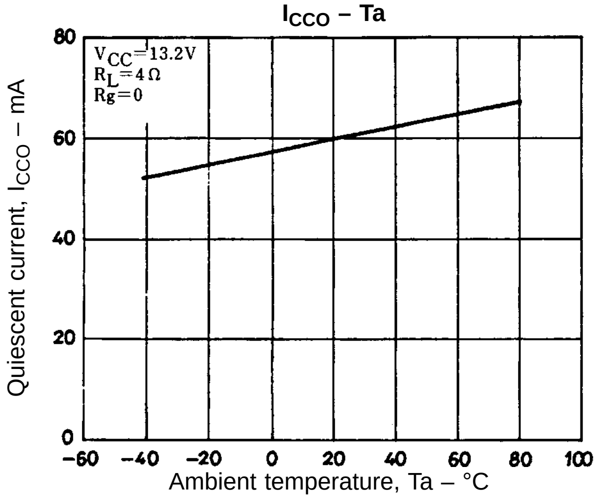
SVRR – V_R



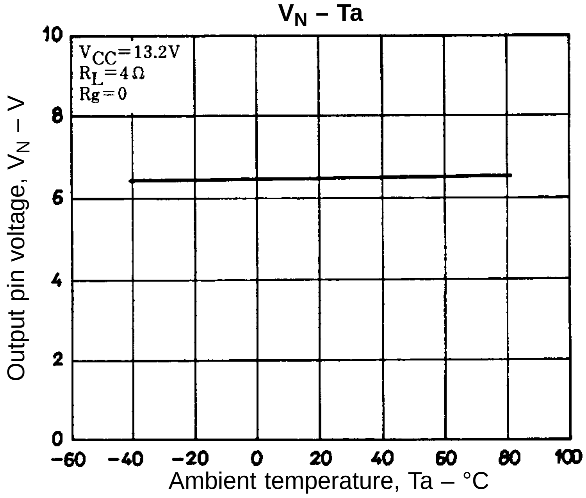
SVRR – fR



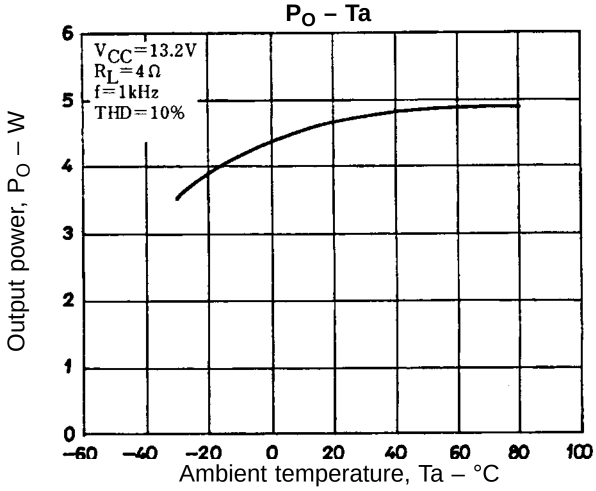
I_{CCO} – Ta

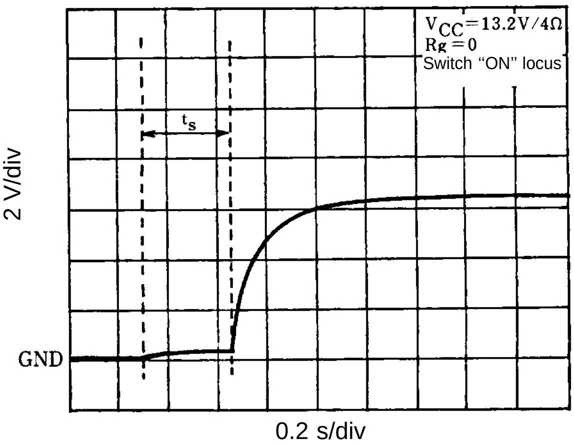


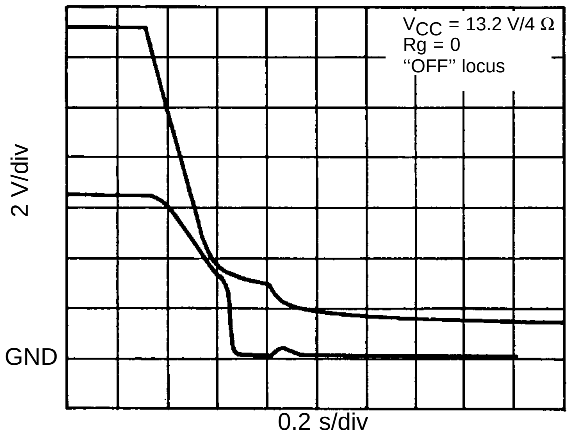
V_N – Ta



P_O – Ta



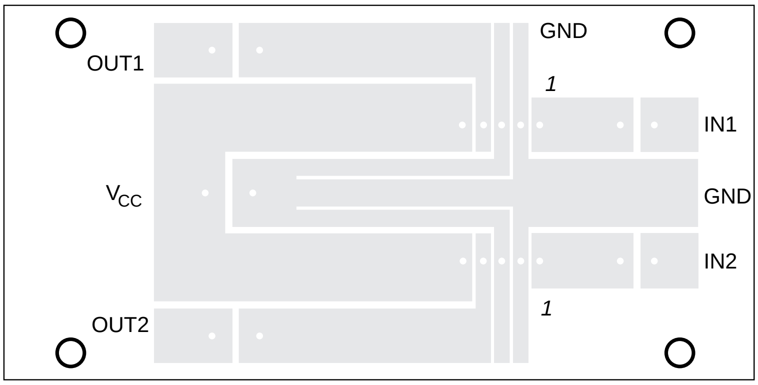




Instructions and Precautions

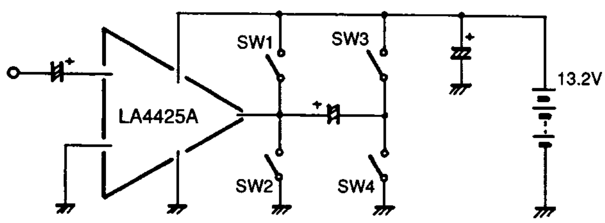
- Connect a capacitor of 1000 pF across pins ① and ② for external disturbance path.
- Be careful of the ground line artwork when laying out the printed circuit pattern. Arrange so that the Sg route and load current flow-in route do not overlap. Refer to the recommended printed circuit pattern or make slits, etc. at pins ② and ③.

DUAL Printed Circuit Pattern Example



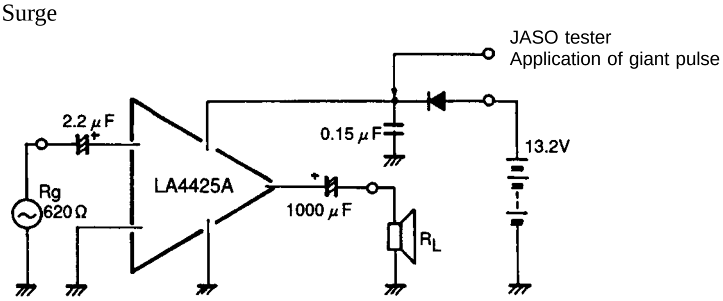
Cu-foiled side 45.0 × 75.0 mm^2

- Short Circuit Tests



Sanyo's recommended printed circuit board: Apply V_{CC} = 13.2 V using a 30 × 30 × 1.5 mm^3 thick aluminum board. The IC will be protected from the DC/AC shorting of switches 1 to 4 above. However, be careful not to damage the IC by turning V_{CC} "ON" when DC short (SW 1 or SW 2) is on.

- Power Supply Positive Surge



The overvoltage protector (V_{CCX} ≒ 21.5 V) inside the IC is used to cut all bias routes and reverse bias between B-E of output stage elements, in order to increase the power line's capability of handling positive surge. This means, of course, that a V_{CES} (V_{CBO}) type output stage element is used instead of the V_{CEO} (V_{CER}) type.

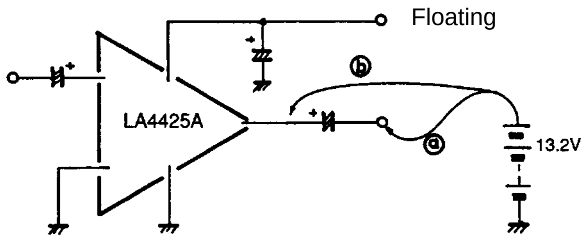
• Load Resistance and Misoperation

It should be noted that when $R_L < 2\ \Omega$ and V_{CC} is high, and the switch is turned "ON" when setting is for a signal (THD = 10 %), the ground detector (current × voltage Schmitt circuit) operates momentarily.

• Precautions on TaB

If power voltage is applied to the IC substrate (the heat sink on a set), the IC structure is such that the PN junctions may be burned, causing deterioration or destruction. Consult Sanyo's Quality Assurance Department with regard to the energy handling capability (voltage peak value, pulse width). Also, the IC TaB (substrate) is connected to pin ③, large signal GND.

• Test of $+V_{CC}$ to Output Pin



The power pin is in a floating state when a power capacitor is connected, so if $+V_{CC}$ touches output lines ⓐ and ⓑ, the upper power transistor inside the IC will be damaged.
The LA4425A has a protective bypass route inside the IC.

• Starting Time (t_s)

This is set at 0.35 sec/typ, but it can be made shorter by making input capacitor Ci smaller, or longer by making it larger.

• Pop noise

The pop noise prevention circuit operates to reduce pop until Rg reaches 50 kΩ. However, if Rg is left open, the charging route of input capacitor Ci is lost, so the pop noise reduction circuit stops operating and click noises become louder.

• VG/OSC

The voltage gain is fixed at 45 dB inside the IC. It is impossible to change it externally.
Phase compensation capacitors (350 pF/total) are connected between individual stages inside the IC, and the open loop gain is low. In addition, the upper and lower drives are made equivalent so that final stage current gain is adjusted, providing a measure against unwanted high-frequency parasitic oscillation peculiar to power IC's.

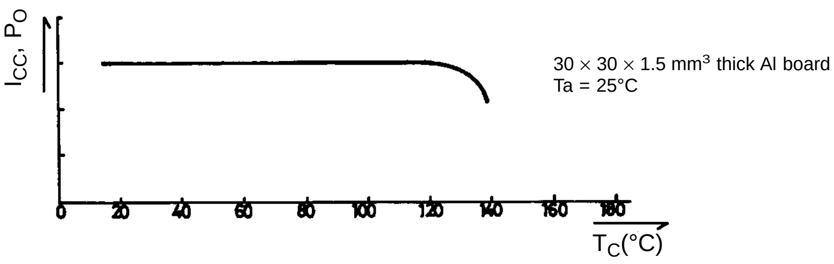
• BTL Connection

Connection is impossible with IC alone.

• Reverse Mounting of IC

The pin assignment is such that there is no danger of damage.

• T.S.D (Thermal Shutdown) Operating Temperature



T.S.D is capable of starting operation at Tc 120 to 130°C. When this is converted to junction temperature (Tj) according to the formula below.

Tj ≒ 165°C,

Tj = Qjc•Pd + Tc

As T.S.D operation progresses, the output pin bias voltage drops, and it becomes harder to drive the upper waveform. Therefore, the current (I_{CC}) and power (P_O) show a tendency to decrease.

Proper Cares in Mounting Radiator Fin

1. The mounting torque is in the range of 39 to 59 N•cm.
2. The distance between screw holes of the radiator fin must coincide with the distance between screw holes of the IC.
3. The screw to be used must have a head equivalent to the one of truss machine screw or binder machine screw defined by JIS. Washers must be also used to protect the IC case.
4. No foreign matter such as cutting particles shall exist between heat sink and radiator fin. When applying grease on the junction surface, it must be applied uniformly on the whole surface.
5. Because the heatsink mounting tab and the heatsink are at the same electric potential as the chip's GND, care must be taken when mounting the heatsink on more than one device.
6. IC lead pins are soldered to the printed circuit board after the radiator fin is mounted on the IC.

This catalog provides information as of June, 1996 . Specifications and information herein are subject to change without notice.